APPENDIX E
WATER QUALITY MONITORING PLAN
BASIS OF DESIGN REPORT
JORGENSEN FORGE EARLY ACTION AREA

Prepared for

U.S. Environmental Protection Agency
Region 10
1200 Sixth Avenue
Seattle, Washington 98101

On behalf of

Earle M. Jorgensen Company
10650 South Alameda Street
Lynwood, California 90262

Jorgensen Forge Corporation
8531 East Marginal Way South
Seattle, Washington 98108

Prepared by

Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, Washington 98101

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LIST OF ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
°F	degrees Fahrenheit
µg/L	Micrograms per liter
AOC	Administrative Settlement Agreement and Order on Consent
BiOp	Biological Opinion
BMP	best management practice
BODR	Basis of Design Report
Boeing	The Boeing Company
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	chemical of concern
CQAO	Chief Quality Assurance Officer
CWA	Clean Water Act
cy	cubic yards
DGPS	differential global positioning system
DO	dissolved oxygen
DSOA	Duwamish Sediment Other Area
EAA	Early Action Area
Ecology	Washington State Department of Ecology
EMJ	Earle M. Jorgensen Company
EPA	U.S. Environmental Protection Agency
EPP	Environmental Protection Plan
ESA	Endangered Species Act
Facility	Jorgensen Forge facility
FSP	Field Sampling Plan
HASP	Health and Safety Plan
Jorgensen Forge	Jorgensen Forge Corporation
LDW	Lower Duwamish Waterway
mg/kg-OC	milligrams per gram of organic carbon
mg/L	milligrams per liter

MLLW	mean lower low water
MOU	Memorandum of Understanding
NMFS	National Marine Fisheries Service
NTCRA	non-time-critical removal action
NTU	nephelometric turbidity units
Owner	EMJ and Jorgensen Forge
PCB	polychlorinated biphenyl
QAPP	Quality Assurance Project Plan
RAB	removal action boundary
RAWP	Removal Action Work Plan
RvAL	removal action level
SQS	Sediment Quality Standard
USACE	U.S. Army Corps of Engineers
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WQMP	Water Quality Monitoring Plan
WQMR	Water Quality Monitoring Report

1 INTRODUCTION

This Water Quality Monitoring Plan (WQMP) has been prepared on behalf of Earle M. Jorgensen Company (EMJ) and Jorgensen Forge Corporation (Jorgensen Forge; herein referred to collectively as the Owner) pursuant to the Administrative Settlement Agreement and Order on Consent for Removal Action Implementation (AOC; U.S. Environmental Protection Agency [EPA] Region X Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA] Docket No. 10-2012-0032) and attached Statement of Work. This WQMP is an appendix to the Basis of Design Report (BODR) Final Design submittal for the cleanup of contaminated sediments and associated bank soils in a portion of the Lower Duwamish Waterway (LDW) Superfund Site adjacent to the Jorgensen Forge facility (Facility) located in Tukwila, King County, Washington (Figure 1; Jorgensen Forge Early Action Area [EAA]). Construction activities planned as part of the cleanup include in-water dredging, placement of in-water backfill and shoreline materials, reconfiguring the shoreline bank, and transport and off-site disposal of impacted sediments and soils. The cleanup will be conducted as a non-time-critical removal action (NTCRA) in accordance with EPA's selected cleanup alternative documented in the *Action Memorandum for a Non-Time-Critical Removal Action at the Jorgensen Forge Early Action Area of the Lower Duwamish Waterway Superfund Site in Seattle, Washington* (Action Memo; EPA 2011) and detailed in the *Final Engineering Evaluation/Cost Analysis [EE/CA]– Jorgensen Forge Facility, 8531 East Marginal Way South, Seattle, Washington* (Anchor QEA 2011).

The purpose of this WQMP is to address substantive requirements of the Clean Water Act (CWA) Section 401 water quality memorandum associated with implementation of the removal action activities.

1.1 Removal Action Description

The limits of the EPA-approved removal action boundary (RAB) are shown on Figure 2, as identified in the EE/CA (Anchor QEA 2011). The removal action extends from the top of the bank at approximately 19 to 20 feet mean lower low water (MLLW) (or top of the sheetpile/concrete panel on the southern portion of the Facility) to the federal navigation channel. The RAB is bounded to the north by The Boeing Company (Boeing) Plant 2

Duwamish Sediment Other Area (DSOA) and Southwest Bank Corrective Measure EAA cleanup area, which is also an EAA.

This document details the water quality monitoring activities and protections that will be implemented during the removal action to minimize adverse impacts to water quality during construction. The removal action includes the following components:

- **Sediment Dredging**. Removal of sediments exceeding the identified polychlorinated biphenyls (PCB) removal action level (RvAL) using a shore-based and barge-mounted precision excavator where implementable based on the encountered materials.
- **Sediment Backfilling**. Placement of imported clean fill material in removal areas to bring these areas back up to a stable grade and elevation.
- **Shoreline Bank Reconfiguration**. Removal of debris, reconfiguration for stability and containment of the shoreline bank; this work is planned to be conducted "in the dry" to the extent possible given LDW elevations during the construction period.

The in-water components of this work would be conducted during the in-water work window, which EPA has allowed from August 1 through February 15. In-water work conducted outside of the work window will only occur in coordination with EPA. Depending on the number of days construction occurs per week (i.e., 5 to 7 days), the total project duration is estimated to take approximately 8 to 12 weeks to complete, including approximately 6 to 8 weeks of in-water work. Construction scheduling details will be further developed in coordination with the selected General Contractor (Contractor) as part of the Removal Action Work Plan (RAWP) documents.

1.2 Water Quality Monitoring Plan Elements

The remainder of this document provides the following information related to water quality monitoring during construction:

- **Section 2 – Water Quality Monitoring Program** describes the monitoring objectives, monitoring approach, compliance boundaries, station locations and depths, and applicable water quality criteria.
- **Section 3 – Activity-Specific Monitoring Requirements** presents specific monitoring activities and schedules for each construction activity.

- **Section 4 – Sampling and Analysis Methods** describes the details of sampling including station identification, sample location and depth control, monitoring methods and equipment, monitoring equipment calibration and maintenance, and measurement documentation.
- **Section 5 – Reporting Requirements** describes the requirements for water quality data submittals and documentation.
- **Section 6 – Contingency Plan** describes exceedance notification requirements, contingency response actions, and construction best management practices (BMPs) to be implemented to minimize water quality exceedance potential.
- **Section 7 – Monitoring Personnel and Key Contacts** details the responsibilities of key monitoring personnel.

2 WATER QUALITY PROTECTION PLAN

A description of each major construction activity, and the environmental protection measures, operational controls, and BMPs that will be implemented to minimize impacts and protect water quality are presented in this section.

2.1 General Water Quality Protection Measures

The following general water quality protection measures will be implemented during all construction activities:

- In-water work for this project will comply with the timing restrictions specified in the in-water work window unless changed in coordination with EPA. EPA has allowed in-water work to occur from August 1 to February 15.
- Prior to entering the water, all equipment will be checked for leaks and cleaned of any external petroleum products, hydraulic fluid, coolants, and other deleterious materials.
- The Contractor will prepare a Spill Containment and Control Plan to be maintained during construction activities. The Spill Containment and Control Plan will contain notification procedures, material storage requirements, emergency response spill containment and cleanup procedures, and employee training requirements.
- The Contractor will prepare an Environmental Protection Plan (EPP), which prevents environmental pollution and minimizes environmental degradation during and as a result of construction operations, including consideration of noise levels and prevention of adverse impacts to air, water, and land. Erosion and turbidity control measures will be included in the EPP.

2.2 Sediment Dredging

2.2.1 Description

The purpose of sediment dredging is to remove surface and subsurface sediments containing elevated concentrations of total PCBs above the RvAL of 12 milligrams per kilogram of organic carbon (mg/kg-OC). Based on characterization data collected in the RAB, all other contaminants above applicable cleanup levels will be removed along with the PCBs. The dredged sediments will be disposed at an EPA-approved Subtitle D landfill. The dredging

depths vary from 1 to 11 feet of removal, with an overdredge tolerance of 2 feet. Dredging adjacent to the sheet pile and concrete panel walls will be offset by 5 feet to minimize potential impacts to the structural stability of the walls.

Approximately 10,800 cubic yards (cy) of material is required to be removed during dredging. Progress and post-construction bathymetric surveys will be performed to confirm contractor estimates of sediments removed from the target areas and to ensure that target elevations are achieved. Following dredging, the removal areas will be backfilled with clean import material to bring the area generally back to its approximate original grade, with the exception of areas within and up to 10 feet outside of the navigation channel, which will not be backfilled fully to grade (e.g., maximum elevation of -15 feet MLLW) to accommodate future maintenance dredging needs by the U.S. Army Corps of Engineers (USACE) in the adjacent navigation channel.

Dredging is anticipated to be completed using mechanical methods. Specifically, an excavator with an articulated, enclosed bucket will be used to the extent possible. However, large debris has been identified in the RAB (e.g., trees, concrete blocks, intact and broken pilings, or molten debris piles) and is likely beyond the lifting capacity of this type of bucket. In such cases, a heavier bucket with digging capabilities or a conventional wire-supported clamshell dredge, grapple, or vibratory hammer may be necessary. The sediments removed during dredging will be placed on a barge equipped to hold the dredged material and associated water, and transported to an EPA-approved offloading and rehandling facility, which is expected to be located on the LDW.

2.2.2 Water Quality Protection Measures

Water quality protection measures that will be applied to sediment dredging work include the following:

- During transport, handling, and off-site offloading of sediment, adequate containment measures and inspections will be employed to minimize spillage of material into the LDW.
- Bottom or beach stockpiling will be avoided at all times.
- Taking multiple bites with the dredge bucket will be avoided at all times.

- Overfilling of the bucket will be avoided at all times.
- Barges will not be overfilled, and will be loaded so that sufficient freeboard remains to allow for safe movement of the barge and its material on its planned route without spillage.
- A clean sand cover (3 to 6 inches) will be placed over dredge cuts in a timely manner and as soon as practical after dredging is complete. This cover will limit the potential for resuspension and release of sediment from the post-dredging residual surface.
- An enclosed environmental type bucket will be used to the extent practicable to limit sediment loss and resuspension during dredging activities; however, in certain conditions (in particular, with the presence of large debris), an alternative bucket type (e.g., digging or clamshell bucket) may be necessary.
- Stair-step dredge cuts for steeper slopes will be implemented to reduce sloughing of sediment, which reduces the potential for sediment resuspension.
- An excavator dredge will be used, as appropriate, for improved bucket control on steeper slopes; this is expected to reduce sediment resuspension on steeper slopes.
- The direct overflow of water in sediment haul barges back to the LDW without proper processing and management of the dredging return water will be prohibited. The water management BMP for this proposed action will involve either active pumping of the excess water from the sediment haul barges to an upland or on-barge treatment system to remove excess sediment and associated contaminants prior to discharging back to the LDW. Excess water will be discharged to the LDW in the immediate vicinity of the dredge platform.

2.3 Sediment Backfilling

2.3.1 Description

Upon completion of the dredging activities, the dredged areas will be backfilled approximately to grade, except in areas within and up to 10 feet outside of the navigation channel as previously noted. The backfill material will be habitat-friendly and consist of a sand and gravel mixture. Backfill activities in dredged areas will be staged from the water side working at higher tides as needed to provide the required draft for the equipment. Backfill materials are anticipated to be placed mechanically from a barge using a clamshell bucket. The material will be placed with sufficient control to meet the design thickness.

Following the placement of the backfill material, a bathymetric survey of aquatic areas will be completed to verify and document that the placed thickness meets the design specification.

2.3.2 Water Quality Protection Measures

Water quality protection measures that will be applied to sediment backfilling work include the following:

- During transport and handling of import material, adequate containment measures and inspections will be employed to minimize spillage of material into the LDW.
- Barges will not be overfilled, and will be loaded so that sufficient freeboard remains to allow for safe movement of the barge and its material on its planned route without spillage.
- Construction quality control procedures will be used to verify the limits and elevations during placement of the backfill materials.

2.4 Shoreline Bank Reconfiguration

2.4.1 Description

The shoreline bank will be excavated to remove impacted nearshore soils and sediments, followed by the placement of a target 4-foot slope containment layer. This portion of the shoreline is degraded, containing elevated chemical concentrations above the Sediment Quality Standard (SQS) criteria, highly armored, and over-steepened banks (approximately 1:1 slopes), and various debris, including derelict creosote-treated piles and asphalt fragments. Bank excavation and subsequent placement of slope containment will stabilize the slope. The proposed shoreline reconfiguration extends from the top of the existing bank at approximately 19 to 20 feet MLLW down to -8 feet MLLW elevation. These excavation and containment activities will be performed from the landside during low tides to the extent practicable to accomplish this work "in the dry" using conventional land-based earthmoving equipment (e.g., excavators, front-end loaders, and dump trucks).

The excavation is proposed to occur over a total distance of approximately 570 linear feet of shoreline. The design excavation depth is between 1 and 11 feet shoreward of the existing ground surface from the toe of slope upwards, and the finished bank will be reconfigured to a

gentler, more stable 2 horizontal to 1 vertical slope (2H:1V; Figure 2). The excavation will result in the required removal of approximately 5,400 cy of impacted soil/sediment, fill material, and debris.

Following excavation, slope containment materials will be placed along the full length and height of the reconfigured slope. The containment will be composed of three layers: a target 1.5-foot "filter" layer (sandy gravel to gravelly sand) overlain by a target 2.5-foot riprap material, and finished with a target 0.5-foot habitat layer (anticipated to consist of rounded or sub-rounded, 2.5-inch minus gravel). The filter layer will act as the chemical isolation layer, the riprap layer will protect the filter layer from erosion, and the habitat layer will provide enhanced substrate for benthic invertebrates and salmonids. Application of the slope containment will result in the placement of approximately 2,500 cy of filter material, 3,800 cy of riprap material, and 1,300 cy of a habitat material (for a total placement volume of approximately 7,600 cy) over approximately a total of 0.75 acres.

2.4.2 Water Quality Protection Measures

Water quality protection measures that will be applied to this work include the following:

- Shoreline excavation and placement of slope containment materials are anticipated to be performed "in the dry" to the extent possible given the LDW tidal elevations during the construction period.
- Construction quality control procedures will be used to verify the limits and depths of excavation, and the limits and thickness of slope containment materials.
- Surface booms, oil-absorbent pads, and similar materials will be made available in case any sheen is observed on the surface of the water during construction.
- Proper erosion and sediment and erosion measures will be implemented, following the guidelines of the *Stormwater Management Manual of Western Washington* (Ecology 2005), to contain the excavated and imported materials and to prevent any materials from entering the LDW during handling, storage, and transport to the off-site disposal facility.

3 WATER QUALITY MONITORING PROGRAM

The objective of water quality monitoring during the removal action is to confirm that water quality criteria are met or to ensure approval to allow temporary exceedances of water quality standards during any construction activity that may affect the water column.

The details of the water quality monitoring program, including monitoring parameters, compliance boundary locations, monitoring station locations and depths, monitoring schedules, and applicable water quality criteria are described below.

3.1 Monitoring Parameters

The following field parameters will be monitored during removal action construction activities (see Table 1):

- Field Parameters
  - Turbidity (in nephelometric turbidity units [NTU])
  - Dissolved oxygen (DO; in milligrams per liter [mg/L])
  - Temperature (in degrees Celsius [°C])
  - Hydrogen ion concentration (in pH units)

In addition, chemical monitoring of the following site chemicals of concern (COCs) will be performed during removal action construction activities (see Table 1):

- Total PCBs (micrograms per liter [µg/L])
- Metals (cadmium, chromium, copper, lead, mercury, and zinc [mg/L])

3.2 Compliance Criteria

Based on the beneficial use classification of the LDW as "excellent quality", the compliance criteria for field parameters will be the Class A (excellent quality) Washington State Surface Water Quality Standards for marine waters (Washington Administrative Code [WAC] 173-201A-210). Compliance criteria for chemical parameters will be the more stringent of the National Recommended Water Quality Criteria and the Washington State Acute Marine Criterion for PCBs and metals. Compliance with these criteria will be evaluated at the EPA-approved point of compliance. These criteria do not apply within the authorized mixing

zone area. Further information about the point of compliance and compliance criteria for the various field parameters and chemical parameters is discussed in the below subsections and summarized in Table 1.

3.2.1 Turbidity

The point of compliance for turbidity will be 150 feet downcurrent of the construction activity (depending on tide direction). Turbidity at the point of compliance shall not exceed five NTU over background turbidity when background turbidity is less than 50 NTU, or have more than a 10 percent increase in turbidity when the background turbidity is greater than 50 NTU.

A biological opinion (BiOp) was issued by the U.S. Fish and Wildlife Service (USFWS) for this cleanup action. In accordance with the BiOp, if at any time, turbidity measured at the 150-foot compliance boundary is 59 NTU greater than the measured background turbidity concentration, additional monitoring would be conducted to confirm that measured turbidity at a distance of 800 feet from the construction work area does not exceed 18 NTU over background turbidity concentration. Monitoring at a distance of 800 feet would be conducted every 2 hours for the remainder of the day, or until measured turbidity falls below 18 NTU over background.

3.2.2 Dissolved Oxygen

The point of compliance for DO is 150 feet downcurrent of the construction activity (depending on tide direction). DO at the point of compliance shall not decrease below 6.0 mg/L. When natural conditions such as upwelling occur, causing the DO to be depressed near or below 6.0 mg/L, natural DO levels may be degraded by up to 0.2 mg/L by human-caused activities.

3.2.3 Temperature

The point of compliance for temperature is 150 feet downcurrent of the construction activity (depending on tide direction). Temperature at the point of compliance shall not exceed 16°C (60.8°F). When the water temperature is naturally warmer than the criterion (or within 0.3°C [0.54°F] of the criterion), then human actions may not cause the 7-day average of daily

maximum temperatures to increase more than 0.3°C (0.54°F). When the natural condition of the water is cooler than the criterion, temperature increases must not, at any time, exceed 12/(*T*-2) as measured at the edge of a mixing zone boundary (where *T* represents the background temperature as measured at a point or points unaffected by the discharge and representative of the highest ambient water temperature in the vicinity of the discharge). Also, when the natural condition of the water is cooler than the criterion, temperature increases resulting from the combined effect of all non-point source activities in the water body must not, at any time, exceed 2.8°C (5.04°F).

3.2.4 Hydrogen Ion Concentration (pH)

The point of compliance for pH is 150 feet downcurrent of the construction activity (depending on tide direction). At the point of compliance, pH shall be within the range of 7.0 to 8.5 with a human-caused variation within this range of less than 0.5 unit.

3.2.5 Chemicals of Concern

The point of compliance for chemical parameters will be 150 feet and 300 feet from the construction work area for acute and chronic water quality criteria, respectively. The acute and chronic criteria are based on the National Recommended Water Quality Criteria and the Washington State Acute Marine Criterion for PCBs and metals (WAC 173-201A-240), as summarized in Table 1.

3.3 Monitoring Locations

During each monitoring event, field parameters (i.e., turbidity, DO, temperature, and pH) will be measured at the background station, and the upriver or downriver early warning station and 150-foot compliance boundary station, as shown on Figure 3. A description of each of these stations is provided below. Early warning and compliance station locations will be based on the distance upriver and downriver from the construction work area. During ebb and slack tides, field parameters will be collected from the early warning and compliance station locations located downriver of the construction work area. During flood tides, field parameters will be collected from early warning and compliance boundary stations located upriver of the construction work area to account for tide reversal. Tide direction will be determined by predicted tides for river mile 3.6 in the LDW. When chemical monitoring is

required, turbidity will also be collected at the downcurrent 300-foot compliance station to determine if a sample is archived or submitted for immediate analysis.

Chemical monitoring, when required, will be performed at the background, 150- and 300-foot compliance stations (Figure 3). Chemistry samples will be collected from both the background and compliance stations (upriver and downriver) regardless of tidal direction. Samples collected at the background and downcurrent 150-foot and 300-foot compliance stations (depending on tide direction) from the depth with the highest concurrent turbidity will be submitted for analysis. Samples collected at the upcurrent 150-foot and 300-foot compliance stations and all other depths will be archived for future potential analysis, pending results of the samples taken at the downcurrent depth with the highest turbidity (see Section 6).

The location of the background station will remain the same for all monitoring events. A description of all monitoring stations is provided below and shown on Figure 3:

- **150-foot Compliance Stations (150C)**. The 150-foot compliance stations are located at the edge of the inner mixing zone 150 feet up and downriver from the construction work area. The 150-foot compliance stations (station 150C) are at approximately the same water depth as the construction activity. Compliance with field water quality criteria will be evaluated at the downcurrent 150C station, depending on tide direction. Compliance with chemical parameter acute criteria will be evaluated at these stations.
- **300-foot Compliance Stations (300C).** The 300-foot compliance stations are located at the edge of the outer mixing zone 300 feet upriver and downriver from the construction work area. The 300-foot compliance stations (station 300C) are at approximately the same water depth as the construction activity. Compliance with chemical parameter chronic criteria will be evaluated at these stations.
- **Early Warning Station (EW)**. The early warning station (Station EW) is located 75 feet upriver or downriver (depending on tide direction) from the construction work area, at approximately the same water depth as the construction activity. The objective of the early warning station is to become more quickly aware of potential field parameter water quality impacts at the construction work area, and to be able to

adjust dredging operations or BMPs before a field parameter exceedance occurs at the compliance station.

- Background Station (BG). The background station (Station BG) is located 600 feet upriver from the RAB and beyond the influence of removal action construction activities. Coordinates of the background station are provided on Figure 3. The background station will be monitored during every event because the turbidity criterion is based on an acceptably small increase (i.e., 5 NTU) in the vicinity of the RAB relative to ambient LDW background levels.

3.4 Monitoring Depths

At each station, conventional and/or chemical monitoring will occur at two depths:

- Surface – 3 feet below the water surface
- Bottom – 4 feet above the mudline

If the water depth is less than 10 feet at the monitoring station, monitoring will occur at the mid-point of the water column (i.e., single depth).

As described in Section 3.3. at stations where water chemistry sampling is required, samples from the depth with the highest turbidity will be submitted for analysis. Samples collected at all other depths will be archived for future potential analysis, pending results of the sample taken at the depth with the highest turbidity (see Section 6). Turbidity will be measured at each compliance station and depth to inform the chemical analyses.

3.5 Monitoring Tiers and Schedules

The in-water components of this work are limited to occur only within the EPA-allowed in-water work window, which extends from August 1 through February 15. In-water work conducted outside of the work window will only occur in coordination with EPA. The total project duration is estimated to take approximately 8 weeks to complete with 5 weeks of in-water work.

Water quality monitoring schedules are divided into three tiers for all in-water work, as summarized in Table 2. Tier I monitoring will be performed during the first 4 days of in-water removal work. Tier II monitoring will occur during all in-water removal work after the first 4 days of monitoring have been performed. Finally, Tier III monitoring will occur during in-water backfill placement. Additionally, chemical monitoring at the Tier I frequency will occur during removal activities performed within three small areas in the RAB showing relatively elevated total PCB concentrations (Figure 4). The following subsections and Table 2 provide a detailed summary of the monitoring schedules for the specific removal action activities.

3.5.1 Tier I Schedule

Tier I monitoring will occur for the first 4 days of in-water removal activity (dredging, in-water debris removal, pile removal or submerged shoreline bank excavation). This monitoring will be conducted concurrent with removal in areas showing the highest relative total PCB concentrations and includes the measurement of field parameters (turbidity, DO, temperature, and pH) twice daily at the background, early warning, and 150-foot compliance stations. In addition, concurrent with field parameter monitoring, water samples will be collected once daily at the background, and 150-foot and 300-foot compliance stations twice during the first four days of monitoring.

The first daily monitoring round should be conducted at least 1 hour after the startup of daily work activities. The second daily monitoring round should be separated by a minimum of 4 hours from the first monitoring round. If practicable, monitoring events should target one flood tide and one ebb tide condition. No monitoring will be performed within two hours before dark and during dark hours due to safety concerns.

As described in Section 3.3, during ebb and slack tides, the early warning and 150-foot compliance stations for field parameters will be oriented downriver. During flood tides, the early warning and 150-foot compliance stations for field parameters will be oriented upriver to account for the reversing tidal current, as shown on Figure 3. When chemical monitoring is required, samples will be collected from both the upriver and downriver 150- and 300-foot compliance stations. Samples collected at the background and downcurrent compliance

stations (depending on tide direction) from the depth with the highest concurrent turbidity will be submitted for analysis. Samples collected at the upcurrent compliance stations and all other depths will be archived for future potential analysis, pending results of the samples taken at the downcurrent depth with the highest turbidity (see Section 6).

3.5.2 Tier II Schedule

After four consecutive days of Tier I monitoring, monitoring may be reduced to the Tier II schedule, which includes measurement of the field parameters (i.e., turbidity, DO, temperature, and pH) twice daily, three days per week. In addition, water samples will be collected for chemical analysis once daily, twice per week. Field parameter and chemical monitoring will be scheduled each week to coincide with removal of the highest relative total PCB concentrations.

As described in Section 3.3, during ebb and slack tides, the early warning and 150-foot compliance stations for field parameters will be oriented downriver. During flood tides, the early warning and 150-foot compliance stations for field parameters will be oriented upriver to account for the reversing tidal current, as shown on Figure 3. When chemical monitoring is required, samples will be collected from both the upriver and downriver 150- and 300-foot compliance stations. Samples collected at the background and downcurrent compliance stations (depending on tide direction) from the depth with the highest concurrent turbidity will be submitted for analysis. Samples collected at the upcurrent compliance stations and all other depths will be archived for future potential analysis, pending results of the sample taken at the downcurrent depth with the highest turbidity (see Section 6).

3.5.3 Tier III Schedule

Tier III monitoring will be performed during in-water backfill placement and includes the one-time measurement of field parameters (turbidity, DO, temperature, and pH) two times in a single day at the background, early warning and 150-foot compliance stations. No chemical monitoring will be performed during backfill placement. No monitoring will be performed within two hours before dark and during dark hours.

3.5.4 Elevated Total PCB Concentration Areas Schedule

During in-water removal activity conducted within the relatively elevated total PCB concentration areas shown on Figure 4, chemical monitoring at the Tier I frequency will occur (i.e., once daily, two days per week). Chemical samples will be collected from the background and upstream and downstream 150C and 300C stations (Figure 3). Downcurrent (depending on tide direction) and background samples collected from the depth with the highest turbidity identified with concurrent turbidity measurements will be submitted for analysis. Samples collected at all other depths and upcurrent compliance stations will be archived for future potential analysis, pending results of the sample taken at the downcurrent depth with the highest turbidity (see Section 6). Field parameters will also be collected at the Tier I schedule.

4 FIELD PROCEDURES

4.1 Methods and Equipment

Water samples for chemical analysis will be collected using a Van Dorn or similar water sampling device deployed to the appropriate depth in the water column. The water sampling device will be decontaminated prior to collection of each sample as described in the Field Sampling Plan (FSP; Attachment 2 to Appendix I). Analytical methods, reporting limits and turnaround times are provided in the Quality Assurance Project Plan (QAPP; Attachment 1 to Appendix I to the BODR).

Field parameters (turbidity, DO, temperature, and pH) will be measured using a real-time, calibrated field instrument (hydroprobe or equivalent) deployed to the appropriate depth in the water column.

4.2 Sample Location and Depth Control

A laser range finder and/or differential global positioning system (DGPS) will be used to navigate to and verify station locations. Field measurements will be collected within 3 meters of the target station locations. Depth to the bottom will be determined using a lead line or depth sounder. Based on the water depth at the time of measurement, the appropriate measurement depths (surface, middle, and deep) will be determined. Location control data (coordinates, water depths) will be carefully documented on the Water Quality Monitoring Form (Attachment 1).

4.3 Station Identification

All stations will be properly identified on the Water Quality Monitoring Form (Attachment 1), and consistently applied from one monitoring event to the next. Station names will use the following identification scheme consisting of up to 13 alphanumeric characters (A-BBBB-C-D-YYMMDD):

In which:

1. The first character [A] will be used to identify the construction activity being monitored:

- R = Removal (e.g., dredging, debris removal, pile removal)
- B = Backfilling

2. The second set of characters[BB] will be used to identify the water quality monitoring location:
   - BG = Background Station
   - EW = Early Warning Station
   - 150C = 150-foot Compliance Station (downriver or upriver of the construction work area)
   - 300C = 300-foot Compliance Station (downriver or upriver of the construction work area)
3. The third character [C] will be used to identify the station orientation:
   - U = Upriver of the Construction Work Area
   - D = Downriver of the Construction Work Area
4. The fourth character [D] will be used to identify the monitoring depth:
   - S = Surface
   - M = Middle
   - B = Bottom
5. The last set of characters (YYMMDD) will be used to identify the monitoring date:
   - YY = The last two digits of the year of collection
   - MM = The month of collection
   - DD = The date of collection

For example, following this identification scheme, "R-150C-U-B-131018" represents field monitoring during removal (R) at the 150-foot compliance station (150C) upriver of the construction work area (U), at the bottom depth in the water column (B) on October 18, 2013.

4.4 Field Documentation

Important field observations and measurement data will be recorded on the Water Quality Monitoring Form (Attachment 1), including the following:

- Station name (see Section 4.3)
- Station coordinates
- Date and time
- Tidal phase (flood, ebb, slack)
- Direction of monitoring, i.e., whether upriver or downriver from the construction activity
- Water depth on station
- Depth in the water column of each field parameter measurement (surface, middle, and bottom depths)
- Weather and current conditions

Completed forms will be scanned at the end of each field day and e-mailed to the Construction Quality Assurance Officer (CQAO).

4.5 Equipment Calibration and Maintenance

Analytical laboratory equipment calibration and maintenance requirements are described in the QAPP (Attachment 1 to Appendix I to the BODR).

Field monitoring equipment will undergo routine and ongoing calibration according to the manufacturers' instructions prior to use in the field. The calibration will be conducted once at the beginning of each sampling day for all equipment. Where not covered by manufacturers' instructions, calibration procedures will follow Standard Methods 2130-b (turbidity) and 4500-O (DO).

For the turbidity meter, at the end of each day of monitoring, a post-calibration procedure will be performed by measuring one of the calibration standards (preferably the standard whose value is closest to the LDW turbidity during that day). In addition, standards may be measured to check the calibration throughout the day, especially if higher or lower than expected turbidity values occur, and to verify a turbidity exceedance, if one occurs.

All calibration information will be recorded in the field notebook. Equipment that does not properly calibrate will not be used.

Instruments and equipment will be tested and inspected before each monitoring event. Any field equipment that is faulty or not functioning properly will not be used for monitoring and will be replaced.

4.6 Quality Control/ Quality Assurance Procedures

Water quality monitoring activities will follow the quality control and quality assurance procedures specified in the QAPP for this project (Attachment 2 to Appendix I to the BODR).

4.7 Health and Safety Procedures

Health and safety procedures applicable to water quality monitoring activities will be implemented as specified in the removal action Health and Safety Plan (HASP; Appendix K to the BODR).

5 REPORTING

Daily, weekly, and final reporting of water quality monitoring results are required for this project, and are described as follows.

5.1 Daily Reporting

Data will be collected and recorded in the field on the Water Quality Monitoring Form (Attachment 1), or equivalent. At the end of each field day, the field forms will be scanned and e-mailed to the CQAO. Unless an exceedance of a water quality parameter occurs (which would trigger the contingency response actions described in Section 6), daily field results will not be transmitted to EPA unless specifically requested.

5.2 Weekly Reporting

The results from each week's water quality monitoring activities will be compiled into a summary table with a comparison to water quality compliance criteria. The weekly summaries will be provided to EPA within 2 business days of the work (i.e., generally by the close of business on Tuesday of the following week). The weekly summary tables and compliance evaluations will be performed by designated office support staff under the direction of the Water Quality Field Leader. All reporting will include both regularly scheduled monitoring and any additional monitoring results that may have been triggered by exceedances of water quality criteria.

5.3 Final Water Quality Monitoring Report

After all construction has been completed, the water quality monitoring data for the entire construction project will be provided to the EPA in a *Water Quality Monitoring Report* (WQMR) as an appendix to the *Removal Action Completion Report*. The WQMR will include the following information:

- Any deviations from the specifications of this WQMP, and reasons for the deviations
- Tabular summaries of all water quality monitoring data with comparisons to water quality compliance criteria

- Narrative text describing the results of water quality monitoring related to each construction operation and removal action activity (e.g., dredging, backfilling, shoreline reconfiguration)
- Narrative discussion of any water quality exceedances, probable cause of the exceedance(s), results of follow-up measurements, agency communications and decisions, and actions taken to mitigate the exceedance(s), including implementation of additional or enhanced BMPs
- Lessons learned regarding BMP implementability and effectiveness
- An appendix containing all completed Water Quality Monitoring Forms
- Documentation of instrument calibration will be provided on request

6 CONTINGENCY PLAN

6.1 Notification Requirements

The primary purpose of water quality monitoring during construction is to determine when water quality impacts may be occurring so that additional operational or engineering controls can be implemented as necessary to mitigate the exceedance. If water quality measurements exceed compliance criteria at the compliance boundary, timely notifications will be made to the Contractor, the CQAO, the Owner's Project Coordinators, and the EPA Remedial Project Manager, as described in this section. The contact information for the EPA Remedial Project Manager and the EMJ and Jorgensen Forge Project Coordinators is provided below:

EPA Remedial Project Manager
Rebecca Chu
EPA, Region 10
1200 Sixth Avenue
Seattle, WA 98101-3140
(206) 553-5122
chu.rebecca@epa.gov

Jorgensen Forge Project Coordinator
Environmental Manager (to be determined)
8531 East Marginal Way S.
Seattle, WA 98108
(206) 965-1352
Email Address (to be determined)

EMJ Project Coordinator
Gil Leon
10650 Alameda St.
Lynwood, CA 90262
(323) 923-6120
gleon@emjmetals.com

The contact information for the CQAO and the Contractor will be provided prior to the start of monitoring activities.

6.2 Exceedances of Water Quality Criteria

This section describes the contingency actions that will occur if the monitoring crew reports an exceedance of conventional water quality parameter, or if an exceedance of the chemical

parameter criteria is detected. The decision flow chart describing the sequence of contingency actions and notifications that will be implemented in response to a water quality exceedance is provided in Figure 5. In the event of an exceedance, additional or enhanced operational or engineering BMPs may need to be implemented. Section 2 of this WQMP should be consulted for a standard list of construction BMPs to protect water quality.

6.2.1 Exceedance of Conventional Parameters

If conventional parameters (turbidity, DO, temperature, or pH) are exceeded at the 150-foot compliance boundary during removal action construction activities, the following contingency actions will be implemented:

1. Immediately notify CQAO. Immediately re-take field measurements at the Compliance Stations (and if necessary, the Background Station) to confirm, or not confirm, the exceedance.
2. If exceedance is confirmed, immediately notify the Contractor, CQAO and EPA.
3. Evaluate the concurrent measurements at the Background Station and supporting evidence to determine whether the exceedance is attributed to removal action construction activities versus other ambient conditions in the LDW (e.g., visual observations, wind waves, boat wakes, barge/ship traffic, or storm inflow).
4. If the exceedance is confirmed and attributed to removal action construction activities:
    a. Immediately notify the Contractor, CQAO, and EPA.
    b. The CQAO will direct the Contractor to expeditiously modify operations or implement additional BMPs to mitigate the exceedance (see Section 2 for list of construction BMPs to protect water quality).
    c. Immediately collect additional chemical water samples at the upstream and downstream 150- and 300-foot compliance stations and background station.
        i. Immediately analyze the background and downcurrent compliance stations (depending on tide direction) from the depth with the highest concurrent turbidity. Archive all other samples for future potential analysis, pending results of the sample taken at the downcurrent depth with the highest turbidity (see Section 6.2.2).

5. Re-take field measurements at all stations 2 hours later, after additional BMPs or operational modifications have been implemented.
6. Within 24 hours, notify EPA of the actions taken to mitigate the exceedance and the results of the follow-up measurements. If the water quality exceedance continues to persist, even with additional BMPs and/or operational modifications, the Owner and/or CQAO will discuss next steps with EPA. The path forward could include some or all of the following:
    a. Implement more aggressive BMPs or operational modifications.
    b. Implement more intensive monitoring to better track the growth or dissipation of the plume.
    c. If options (a) or (b) are not successful at controlling the water quality exceedance, it may be necessary to temporarily stop work to further assess the source of the exceedance, identify effective mitigation measures, and allow the water column to recover. Additionally, samples may be collected at 200 and 250 feet from construction activity to support a potential modification to the 150-foot mixing zone.

6.2.2 Exceedance of Chemical Criteria

If acute criteria are exceeded at the downcurrent 150-foot compliance boundary at the depth with the highest turbidity, or chronic criteria are exceeded at the downcurrent 300-foot compliance boundary at the depth with the highest turbidity, the following actions will be implemented:

1. Immediately notify the Contractor, CQAO, and EPA.
2. In consultation with EPA, evaluate the concurrent measurements at the Background Station and supporting evidence to determine whether the exceedance is caused by removal action construction activities versus other ambient conditions in the LDW (e.g., visual observations, wind waves, boat wakes, barge/ship traffic, other construction activity within the LDW, or storm inflow).
3. If exceedance is attributed to removal action construction activities:
    a. Assess construction methods and existing BMPs.

b. Analyze concurrent archived samples collected at the compliance boundary (both upstream and downstream) where exceedance was observed to determine if 1-hour average concentrations exceed the compliance criteria.
c. If 1-hour average concentrations at the 300-foot compliance boundary exceed the chronic criteria, analyze remaining archived samples collected at the 300-foot compliance station on the day of the exceedance to determine if 24-hour concentrations exceed the compliance criteria.

4. If average concentrations exceed the compliance criteria, discuss path forward with EPA. The path forward could include some or all of the following:
   a. Implement more aggressive BMPs or operational modifications.
   b. Implement more intensive monitoring to better track the growth or dissipation of the plume.
   c. If options (a) or (b) are not successful at controlling the water quality exceedance, it may be necessary to temporarily stop work to further assess the source of the exceedance and identify effective mitigation measures. Additionally, samples may be collected at 200 and 250 feet from construction activity to support a potential modification to the 150-foot mixing zone.

6.3 Distressed or Dying Fish

In the event distressed or dying fish are observed in the RAB and are attributed to removal action activities, work will immediately stop and the Ecology, the Washington Department of Fish and Wildlife (WDFW), and the National Marine Fisheries Service (NMFS) will be contacted at the numbers listed as follows:

- Washington Military Department Emergency Management Division at (800) 258-5990
- Anne Friesz, WDFW, at (360) 906-6764
- NMFS Office of Law Enforcement at (503) 231-6240 or (206) 526-6133

The condition of the fish (dead, dying, or erratic behavior); an estimate of the number, species, and size of fish in each condition; and, the location of fish relative to construction

operations will be noted. If any dead Endangered Species Act (ESA)-listed species are present, samples will be frozen in secure storage under chain-of-custody for possible agency inspection. Additional fish and water sampling may be conducted at the direction of the resource agencies.

6.4 Discharge of Oil, Fuel, or Chemicals

In the event of a discharge of oil, fuel, or chemicals (including wet concrete) into the LDW resulting from removal action construction activities, work will stop and containment and cleanup efforts shall begin immediately and be completed as soon as possible. Work may resume only after the source of the spill or leak has been identified and controlled, as long as the work does not interfere with, delay, or hinder the containment and cleanup efforts. Cleanup includes appropriate disposal of any spilled material and cleanup material. The following agencies will be immediately notified:

- Ecology's Spill Response Office at (360) 407-6300
- Washington State Emergency Management at (800) 258-5990
- National Response Center at (800) 424-8802

7 MONITORING PERSONNEL AND RESPONSIBILITIES

Key monitoring personnel required to implement this WQMP include the following:

- Water Quality Field Leader
- Monitoring personnel
- CQAO

Persons fulfilling these roles will be designated at least 1 week prior to the start of monitoring activities, and contact information will be provided at that time to the EPA, the Owner's Project Coordinators, the CQAO, and the Water Quality Field Leader. All monitoring personnel will be experienced in the collection and measurement of water quality parameters.

7.1.1 Water Quality Field Leader

The Water Quality Field Leader will be responsible for:

- Oversight of all water quality monitoring activities and field personnel
- Verification that results are properly recorded and forms are completely filled out
- Verification that appropriate calibration and quality control/quality assurance procedures are being implemented
- Notifying the CQAO in the event that water quality exceedances are observed, and providing the CQAO with all necessary supporting field documentation to be able to determine an appropriate path forward in consultation with EPA

Under the oversight of the Water Quality Field Leader, monitoring personnel will be responsible for conducting the field activities, required instrument calibrations, quality assurance and quality control procedures, and documentation of results in daily field reports.

7.1.2 Construction Quality Assurance Officer

The CQAO will be responsible for:

- Reviewing field reports to verify that appropriate field methods and quality control procedures are being implemented in accordance with the procedures specified in this WQMP

- Weekly reporting of water quality results to the EPA Project Manager
- Notifying EPA if a confirmed water quality exceedance is observed, and coordinating with EPA to determine an appropriate path forward if a response action is warranted
- Coordinating with the Contractor to ensure appropriate construction BMPs are being implemented, and to strategize ways to add BMPs or enhance the effectiveness of existing BMPs as necessary to mitigate unacceptable water quality effects

8 REFERENCES

Anchor QEA, 2011. *Final Engineering Evaluation/Cost Analysis – Jorgensen Forge Facility, 8531 East Marginal Way South, Seattle, Washington*. Prepared for the U.S. Environmental Protection Agency. March 2011.

Ecology (Washington State Department of Ecology), 2005.*Stormwater Management Manual of Western Washington.* February 2005.

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EPA (U.S. Environmental Protection Agency), 2011. Action Memorandum for a Non-Time-Critical Removal Action at the Jorgensen Forge Early Action Area of the Lower Duwamish Waterway Superfund Site in Seattle, Washington. Seattle, Washington.

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